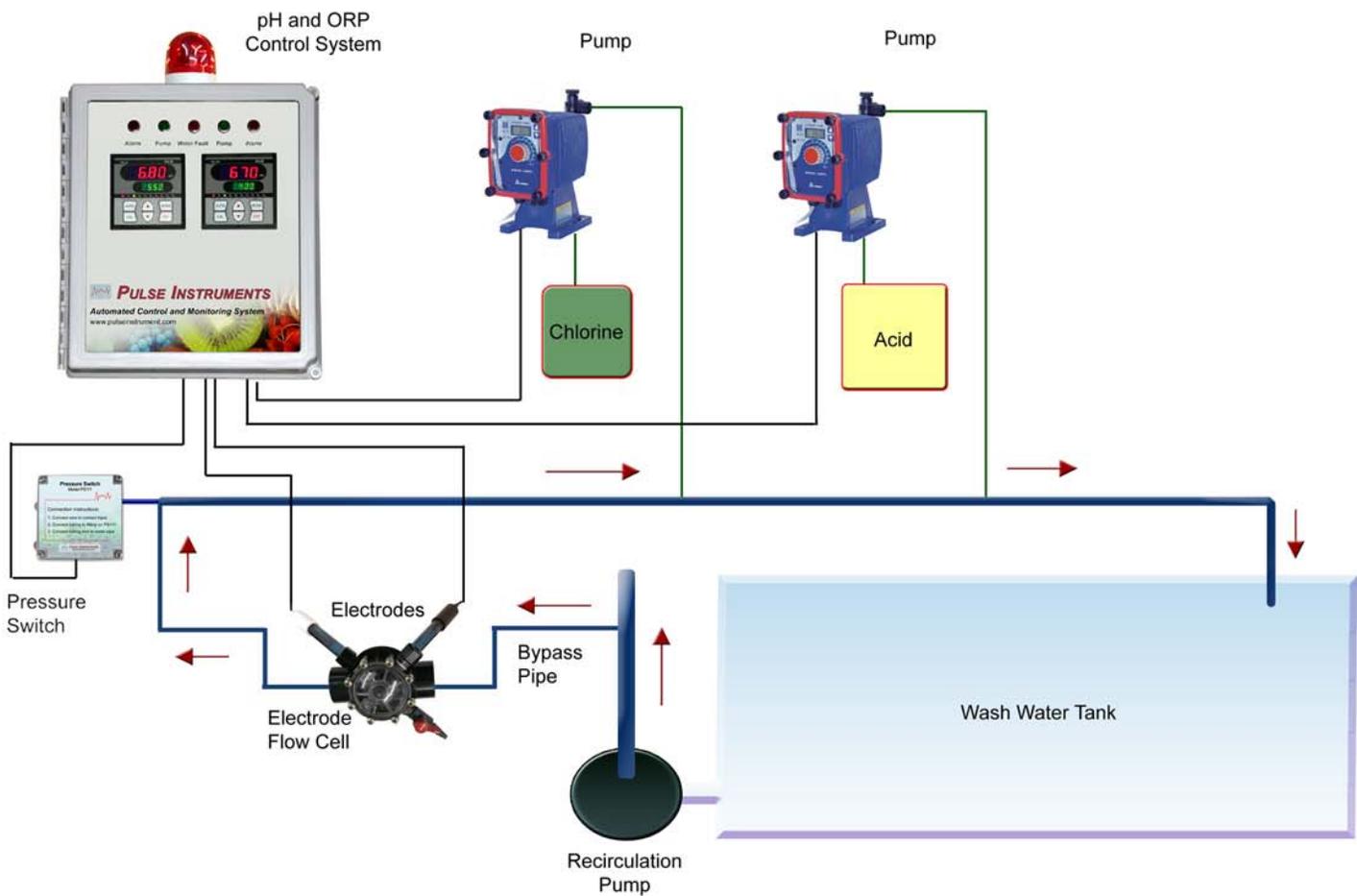




PULSE INSTRUMENTS

User Manual System 3



www.pulseinstrument.com

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1. Overview

1.1 Introduction

Fresh fruit and vegetable harvesting, post-harvest handling and cooling, packing and processing activities that involve the use of water have a higher potential of contamination by plant pathogens and microbes. Small errors in contamination prevention and water disinfection procedures can have severe consequences due to the ease of spread of microbes, particularly in re-circulated water systems.

Accurate monitoring and recording of disinfection procedures is an important component of a sound post-harvest quality and safety program. Oxidation-Reduction Potential (ORP), measured in millivolts (mV), has been introduced to fresh produce packers and shippers as an easily standardized approach to water disinfection for harvest and post-harvest handling. Operationally much like a digital thermometer or pH probe, ORP sensors allow the easy monitoring, tracking, and automated maintenance of critical disinfectant levels in water systems.

The purpose of this manual is to provide users instructions on how to operate the water disinfection system and a brief overview of the application of ORP monitoring to post-harvest sanitation processes.

For more information on water disinfection, pH, and ORP, please visit www.pulseinstrument.com.

1.2 Features

The System 3 dual pH and ORP control system is housed in a NEMA 4X weatherproof enclosure, which is an essential HACCP tool. It includes a programmed logic controller (PLC) based logic controlled alarm and safety shut down. The audio alarm is 80 decibels with a front panel pilot light. The safety shut down automatically turns off the chemical pumps to prevent any hazardous situations. This simple modular design offers affordable continuous monitoring and control, which allows unique hands-free operation and future upgrade capability for recording.

- Works with any oxidizer
- Sensors monitor pH and ORP
- Controller automatically turns chemical pump On or Off as needed
- Always maintains a tight chemical concentration range
- Injects chemical only as needed
- Self maintains and adjusts to organic load
- Smart logic allows “Hands-Free” Operation
- Recording maintains continuous traceability
- Self-cleaning sensors allow for low maintenance

2. Specifications

Condition	Specifications
Range	pH: 0.00 to 14.00 pH ORP: 0 to 1000 mV Temperature (Optional): -50 °C to 1000 °C (-58 °F to 1832 °F)
Resolution	pH: 0.01 pH ORP: 1.0 mV Temperature (Optional): 1 °F
Accuracy	pH: ± 0.02 pH (± 1 digit) ORP: ± 0.1 % (± 1 digit) Temperature (Optional): ± 0.2 % of FS
Power	110 VAC; 10 Amps
Control Panel Weight	18 lbs
Control Panel Dimension	Height x Width x Depth: 14 in x 12 in x 8 in

PLC Inputs and Outputs

Pins	Descriptions
X0	pH acid input
X1	pH alarm input
X2	ORP oxidation input
X3	ORP alarm input
X4	Water fault input
X5	Temperature alarm
X6	--
X7	Consent
Y0	pH acid pump output
Y1	ORP oxidation pump output
Y2	pH alarm light output
Y3	ORP alarm light output
Y4	Water fault output
Y5	Audio Alarm output

3. Function

3.1 Operation

The system 3 provides complete automation of the water disinfection and chemical treatment process with unique capabilities for a “Hands-Free” operation of water treatment. This allows for true automation 24 hours a day and works with any oxidizer such as chlorine, chlorine dioxide, bromine, ozone, peroxide, and peroxyacetic acid.

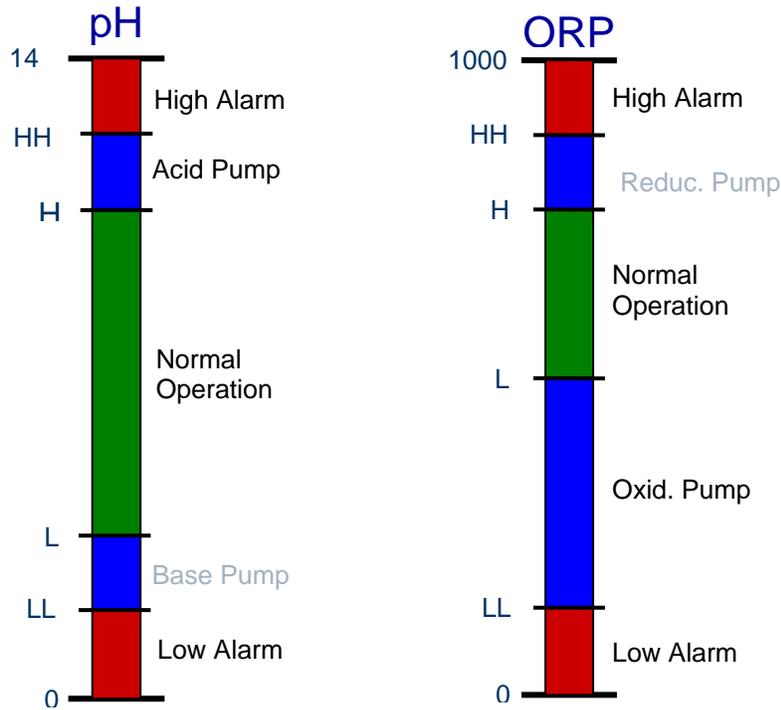


Fig. 1 pH and ORP Control Concept

pH has four set points: low alarm, base chemical injection control (not available), acid chemical injection control, and high alarm. ORP also has four set points: low alarm, oxidation injection control, reduction chemical injection control (not available), and high alarm.

pH

- High alarm: turns on above HH
- Acid pump: turns on above H
- Low alarm: turns on below LL

ORP

- High alarm: turns on above HH
- Oxidation pump: turns on below L
- Low alarm: turns on below LL

Hysteresis / dead-band eliminate output chatter at the switch point (See Fig. 2).

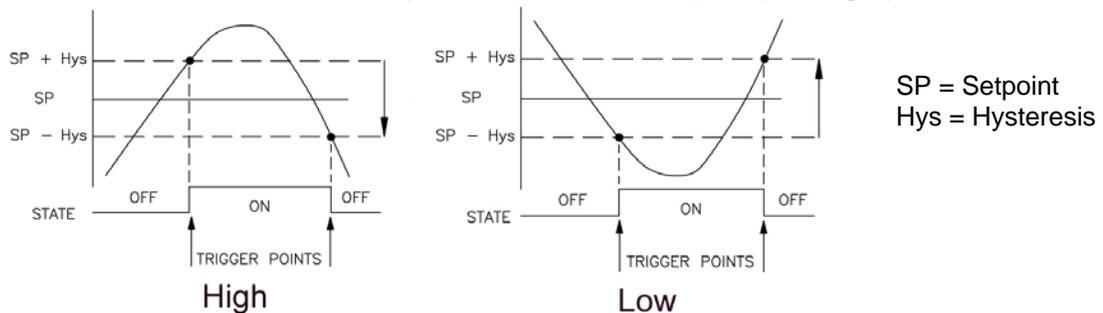


Fig. 2 Hysteresis / Dead-band

3.2 Control

3.2.1 pH / ORP

Under normal conditions, pH is controlled by the system to the pH level set at the controller. When the pH rises above the high set point value (H), the acid pump automatically turns on via a control relay and adds acid to the water until the pH drops down to the set point value, and then shuts off.

Under normal conditions, ORP is controlled by the control system to the ORP level set at the controller. When the ORP value drops below the low set point value (L), the oxidation pump automatically turns on via a control relay and adds oxidizer to the water until the ORP value rises to the set point value, and then shuts off.

3.2.2 Consent

The consent jumper, (See Fig. 3), determines the precedence of the pumps controlled by the controller. In other words, when the consent jumper is in place, the acid pump takes priority over the oxidation pump. Whenever the acid pump is on, the oxidation pump will never be on, even if the value of its ORP is under the set point. The consent jumper is used to prevent harmful gases from being produced when certain chemicals are mixed together at the same time.

In contrary, when the consent jumper is removed, both pumps will work independently according to each of their set point values.

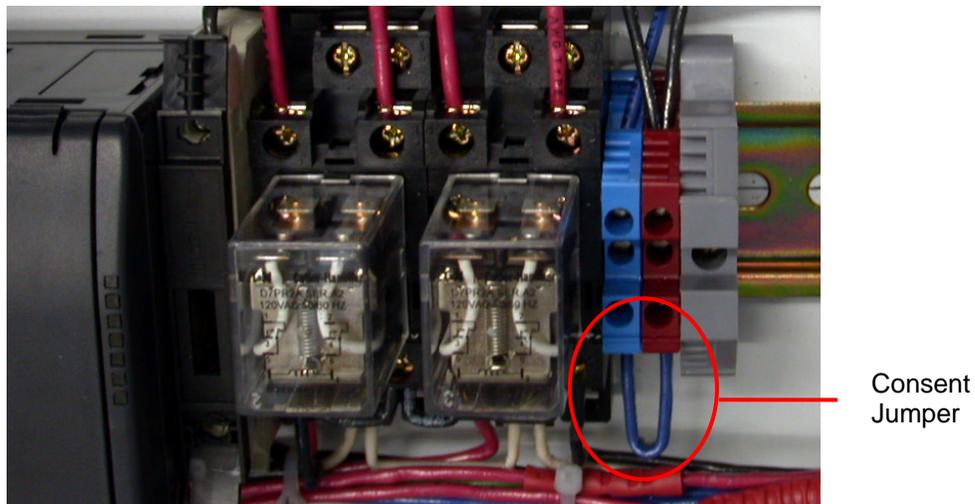


Fig. 3 Consent Jumper

3.3 Safety Alarm

An alarm condition occurs due to process failure if levels exceed the specified alarm limits of alarm set points (HH or LL). The chemical pump is shut-off and an audio-visual alarm is activated until conditions fall within limit.

3.3.1 Alarm Contact

If the pH value passes its High or Low Alarm set point, the pH Alarm pilot light on the front of the control panel will flash, and the Audio Alarm will sound. pH going into its alarm condition will also cause both the pH and ORP chemical pumps to shut off, even if the ORP value is below its pumping set point.

If the ORP value passes either its High or Low Alarm set point, the ORP Alarm pilot light on the front of the control panel will flash, and the Audio Alarm will sound. ORP going into its alarm condition will also cause its own chemical pump to shut off. The pH works independently from the ORP; the pH chemical pump will continue to pump even if the ORP goes into alarm.

If the temperature value passes either its High or Low Alarm set point, the Audio Alarm will sound. Temperature alarm will not influence pH or ORP control.

3.3.2 Alarm Silence

If there is an alarm, turn on the “Silence Alarm” switch on the side of the panel to silence the alarm noise. Do not forget to turn off the “Silence Alarm” switch after the problem is fixed.

3.3.3 Power ON

This feature is activated when the control panel is supplied with power (turned on). A logic mode is activated at power on so that for the first 30 minutes all alarms are ignored and chemical feed is allowed to occur by the acid and chlorine pumps, if required by the controller.

3.3.4 Water Fault

If there is a “Water Fault”, the alarm function is disabled, and a pilot indicator light on the front panel flashes On / Off.

3.4 Flow Switch / Pressure Switch

A flow switch / pressure switch interface only allows the operation to occur if there is flow / pressure in the process. If this feature is being utilized, the logic works, so that if there is water flow through the electrode flow cell, the chemical injection will start treating the water as needed. If no flow / pressure is detected, the control system will continue monitoring and recording, but will not allow any chemical injection. No water treatment will occur in the absence of flow / pressure. In the “Water Fault” condition, the alarm function is disabled, and a pilot indicator light on the front panel flashes On / Off.

4. System Components

PLC	DO-05AR
pH	170E-pH
ORP	170E-ORP
pH Electrode	PI0020-pH
ORP Electrode	PI0020-ORP
Flow Cell	FC04 / 2PRS001
Pressure Switch / Flow Switch	PS111 / FS-400PC-02
Two Chemical Pumps	EK / EW Series
Temperature (optional)	FD5000
Thermocouple (optional)	Type J

5. System Layout

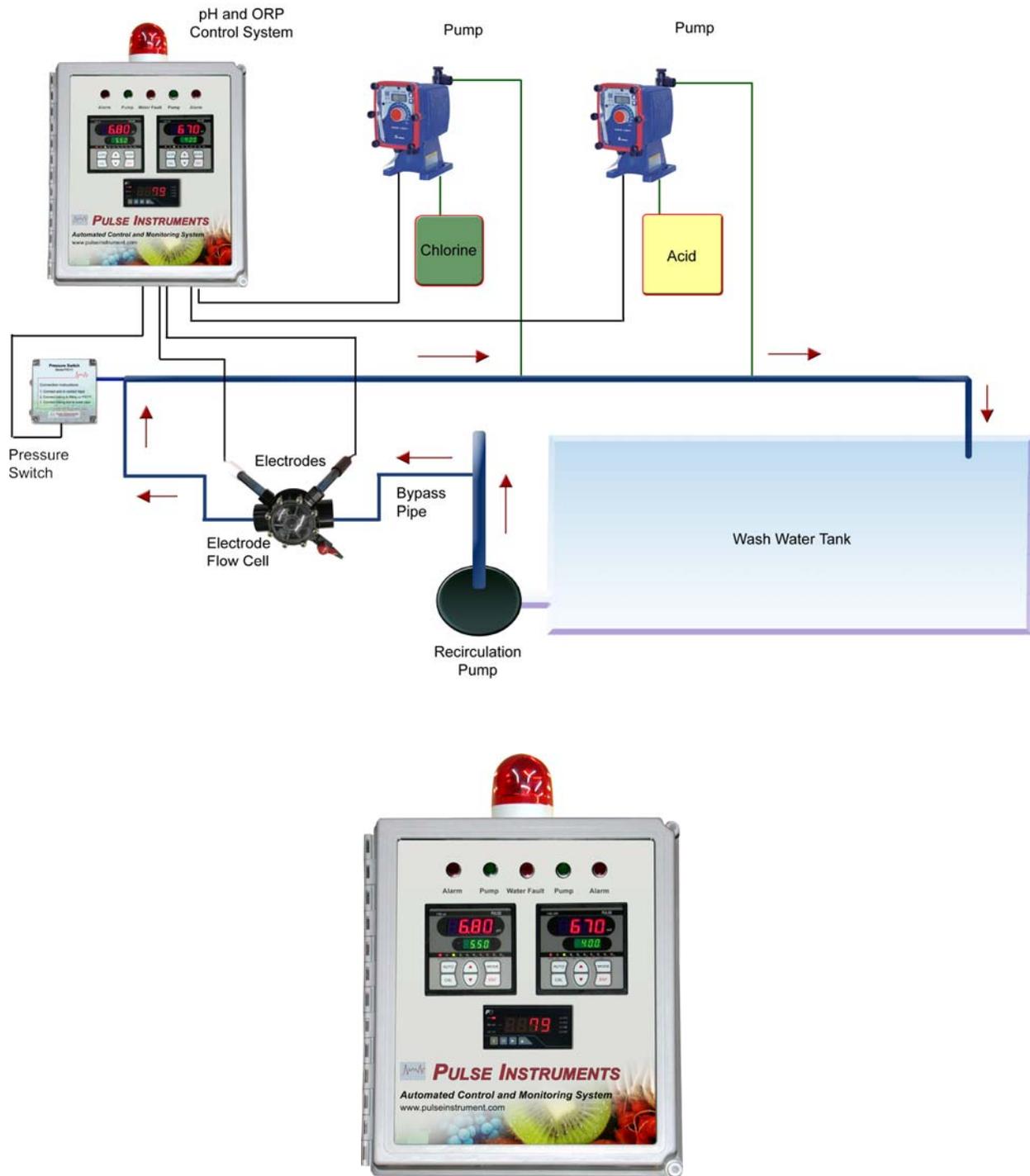


Fig. 4 Automation of Wash Water Sanitation System Diagram

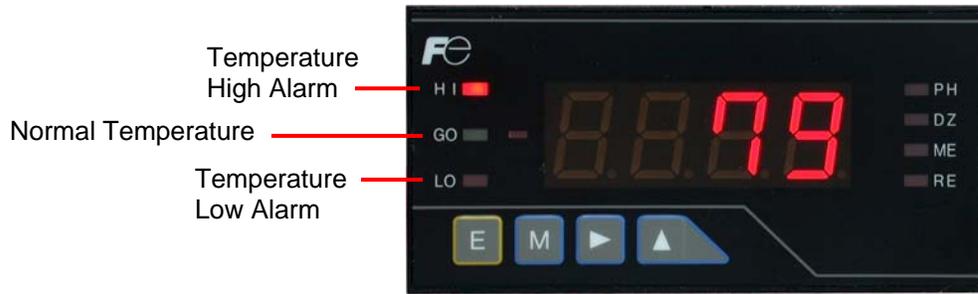


Fig. 5 Temperature Meter (Optional)

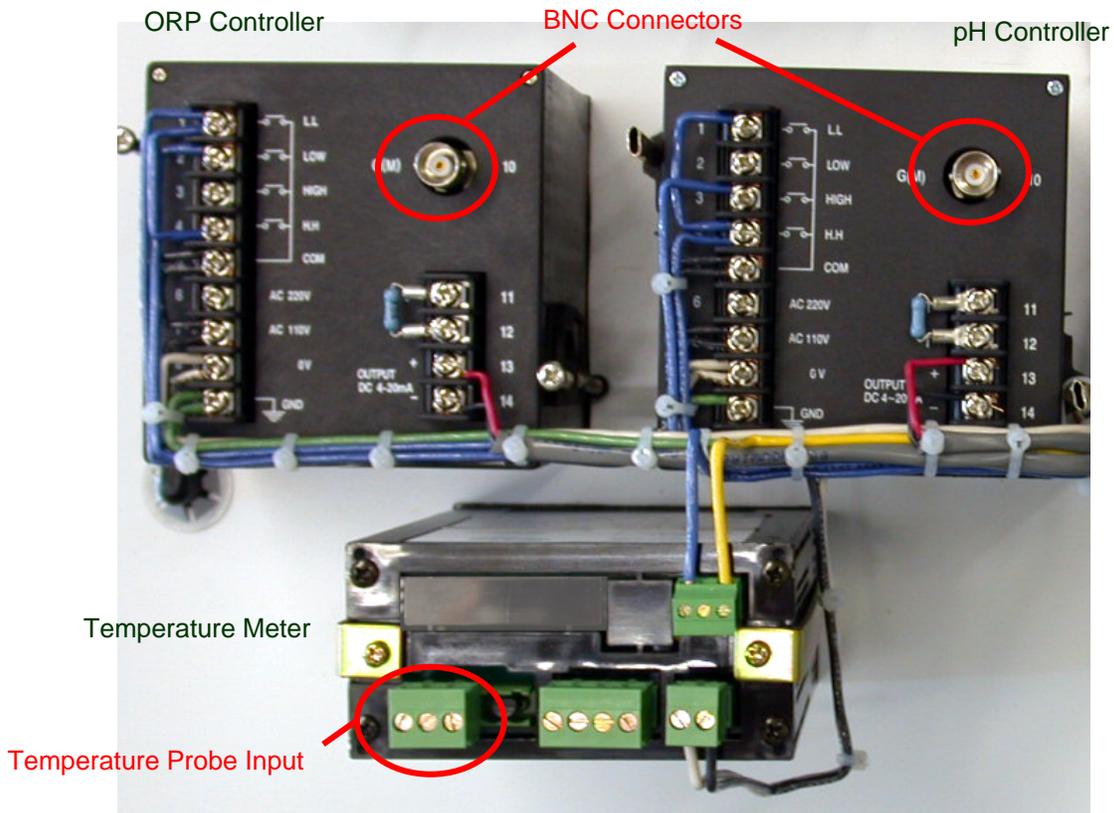


Fig. 6 Back of the Front Plate: pH, ORP, and Temperature Input

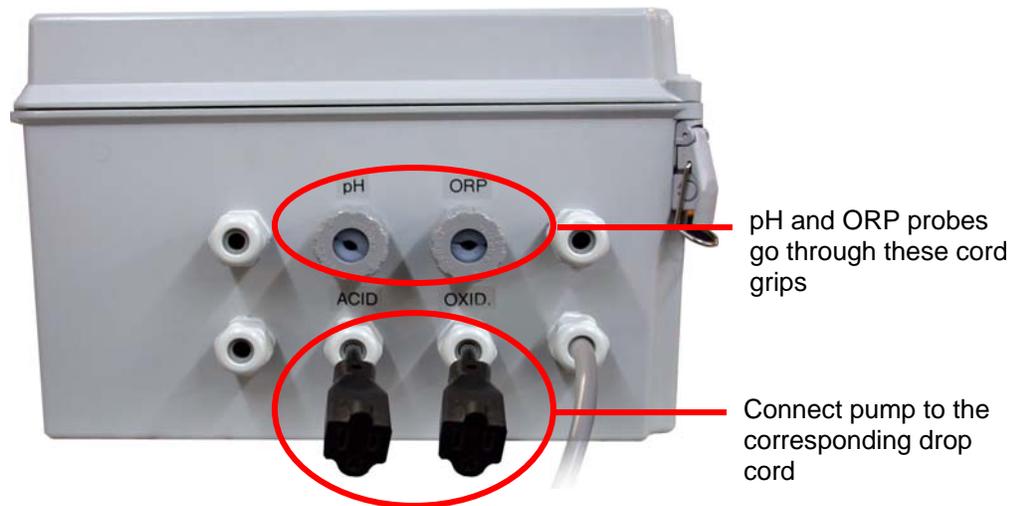


Fig. 7 Bottom of the Control Panel

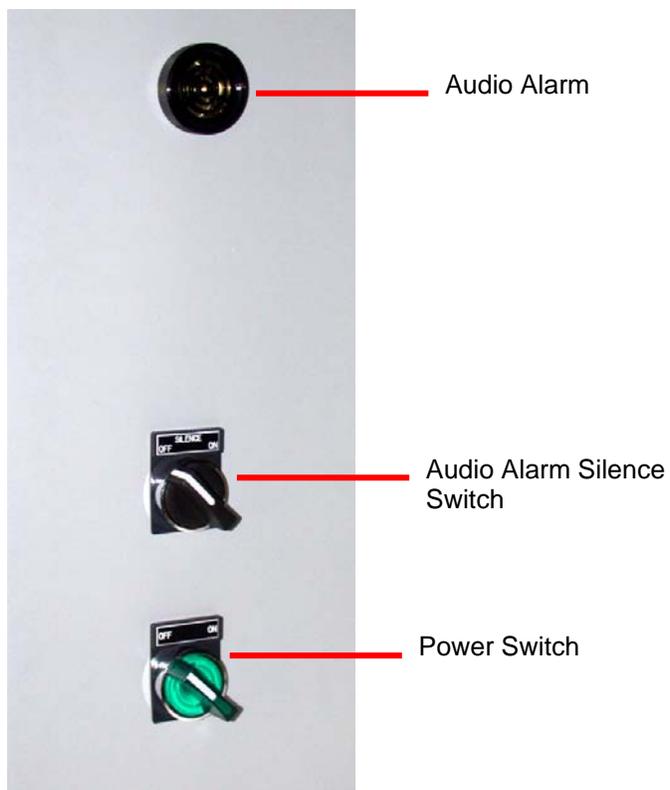


Fig. 8 Side of the Control Panel

6. Installation

The two primary components: Control Panel and Electrodes, should be preferably mounted as close to one another as possible but no greater than 50 feet apart. (See the system layout, Fig. 4).

6.1 Instrument Control Panel

6.1.1 Mounting and Location

Mount the control panel on a secure stand, bracket or wall using the mounting feet provided. The location of the control panel should be determined according to process layout, keeping in mind that it is preferable to locate the control panel in a dry environment, whenever possible, even though it is rated for wet environments at NEMA 4X.

The control panel should be accessible for routine maintenance, and easy viewing of the front digital display as well as the Visual Alarm, and in hearing range of the 80 db Audio Alarm. It should also be located with enough space underneath of at least two feet for mounting the Injection manifold, along with the switches and cables.

6.1.2 Electrical and Power

The control panel requirements are **110 VAC at 10 Amps**. The control panel is supplied with a three prong grounded plug. Extra attached loads such as valves, mixers, and other such devices, should be accounted for in the total electrical requirements.



WARNING: To reduce the risk of electric shock, the control panel must be plugged into a grounded outlet with ratings conforming to the requirements of the control panel, and any other electrical loads connected to it. The control panel should be connected to a good ground. **DO NOT USE ADAPTERS!** All wiring must conform to local electrical codes.

6.1.3 Terminal Strip Wiring

From Left to Right

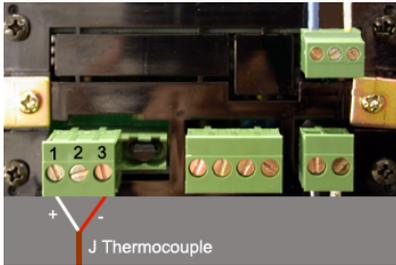
1. Acid Pump
2. Oxid Pump
3. Neutral
4. Ground
5. Flow Switch
6. Flow Switch
7. (+) 4-20mA pH
8. (-) 4-20mA pH
9. (+) 4-20mA ORP
10. (-) 4-20mA ORP
11. (+) mA/mV Temp (optional)
12. (-) mA/mV Temp (optional)

6.2 Sensor Input Connection

Bring in the male BNC connectors of the pH and ORP probes through the two large cord grips at the bottom of the control panel (see Fig. 7) and connect each to their appropriate female BNC connectors on the pH and ORP monitors (see Fig. 6). Bring in the temperature probe wire through the cord grips at the bottom of the control panel and connect the probe to the temperature meter (see Section 6.3.1 for connection detail).

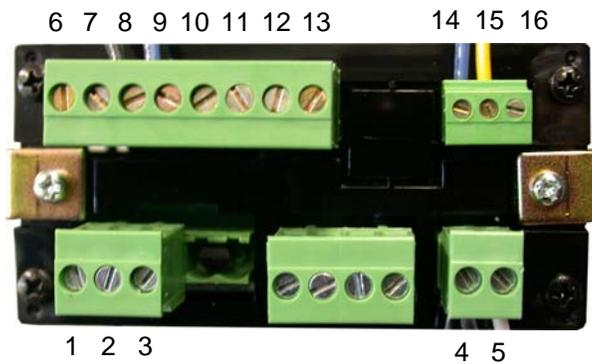
6.3 Temperature Controller Connection (Optional)

6.3.1 Connect J Thermocouple



Connect the positive (White wire) of the J Thermocouple to terminal 1 and the negative (Red wire) of the J Thermocouple to terminal 3 on the back of the temperature meter.

6.3.2 Terminal Description



No.	Description
1	Positive terminal for thermocouple
2	--
3	Negative terminal for thermocouple
4	Power terminal (No polarity)
5	Power terminal (No polarity)
6	Normally closed terminal for Low set point output
7	Common terminal for Low set point output
8	Normally open terminal for Low set point output
9	Common terminal for GO output
10	GO output terminal
11	Normally closed terminal for High set point output
12	Common terminal for High set point output
13	Normally open terminal for Low set point output
14	Common terminal for analog output
15	Current output terminal (4-20 mA)
16	Voltage output terminal (1-5 V, 0-1 V, and 0-10 V)

6.4 Flow Cell

The flow cell allows water to enter from one end of the flow port and exit the other, while the electrodes take their measurements.

6.4.1 2PRS001



Specification:

- Used in clean water application
- Holds pH and ORP electrodes
- ½" NPT Ports

- Installation: install a straight pipe from one end of the flow cell to the other end.

6.4.2 FC04

Flow Cell



Flow Cell Installation



The pipe is in a U-shape to trap water, so that the electrodes will stay wet. For some electrodes, it is essential that they stay wet at all time.

Specification:

- Used in dirty water or water with some solids applications
- Holds pH and ORP electrodes (1/2" NPT)
- Two large water flow ports (1 ¼" NPT)
- Sampling port
- Extra port

6.5 Flow Switch / Pressure Switch

6.5.1 Flow Switch



Connection Instructions:

1. Connect wire from the flow switch to the contact input (See Section 6.1.3).
2. Connect flow switch to water pipe.

6.5.2 Pressure Switch



PS111



Pressure Switch inside the Enclosure

The PS111 pressure switch with NEMA 4X is designed to make a dry contact in the event of a change in the flow followed by a change of pressure. It may be used as a flow switch. The sensitivity of the pressure switch can be adjusted by turning the dial inside of the receptacle (see picture on the right). For high pressure, reduce sensitivity by loosening the dial. For low pressure, increase sensitivity by tightening the dial.

The PS111 is easy to use and simple to install. Fittings, 5 feet cable with terminal forks, along with 5 feet tubing are provided in the package.

Specification:

Pressure (MAX): 100 PSI

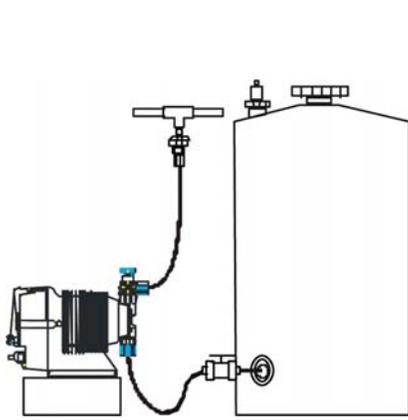
Adjustable Range: 1.5 – 15 PSI

Connection Instructions:

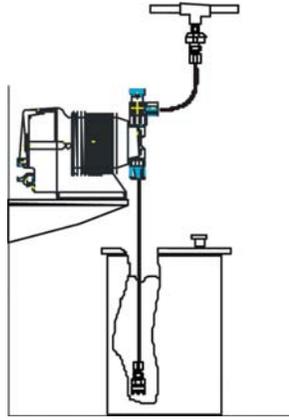
3. Connect wire (from 5 feet wire cable) to contact input (See Section 6.1.3).
4. Connect tubing to fitting on PS111.
5. Connect tubing end to the water pipe.

6.6 Chemical Metering Pumps

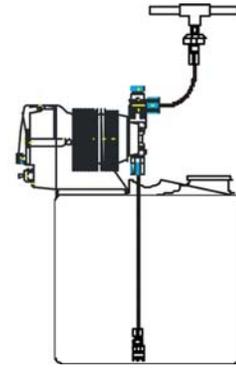
Choose a clean and dry location for the pump, which is close to an electrical outlet and allows for convenient access to stroke length control, frequency control, and tubing connections. Avoid areas where ambient temperature exceeds 122 °F (50 °C), falls below 32 °F (0 °C), or where the pump or tubing would be exposed to direct sunlight (See the pump manual for details).



Flooded Suction Mounting
Recommended for liquids that out-gas



Shelf Mount
Maximum 5 feet suction lift



Tank Mount
Maximum 5 feet suction lift

7. Configuration / Setup

7.1 Power Up



To set up a new unit, first check that the power supply connections are correct, that the outlet is 110 VAC, and that the connection and power source are clean of any ground loops, inductive loads or magnetic fields. Shared loads on the same circuit may cause interference; therefore a clean power circuit is recommended. Also, when using the AC supply, ensure that a 3-way grounded mains lead is used to connect the unit.

Switch on the power to the unit via the lighted On / Off switch that is located on the side of the control panel. The switch light should turn on the front instrument displays with indicated values on their screen.

7.2 pH and ORP Control Set Points

Before we begin operations, we must first define the process parameters. Set control and alarm set points and dead band. See Section 3.1, Fig. 1, for graphic information.

		Factory Preset
pH Low Low	Low Alarm	5.5
pH Low	Base	6.0
pH High	Acid	6.8
pH High High	High Alarm	8.5
pH dead band	Hysteresis	0.1
ORP Low Low	Low Alarm	400 mV
ORP Low	Oxidation	670 mV
ORP High	Reduction	800 mV
ORP High High	High Alarm	900 mV
ORP dead band	Hysteresis	5 mV

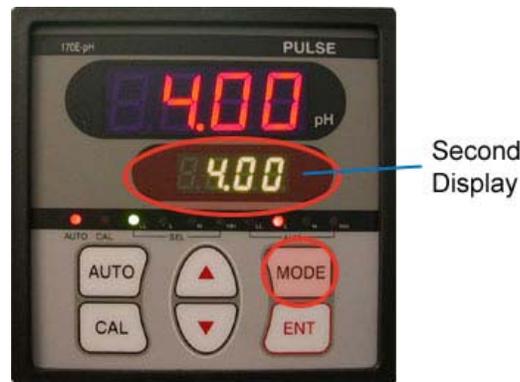
On the controller, the green digit display (second display) indicates the value of the selected set point, which is indicated by the corresponding small green LED light.

Choose the desired set point by pressing the “MODE” button. Pressing it again moves to the dead band (hysteresis) selection. Pressing the “MODE” button again moves to the next set point selection. Hold the “MODE” button down for 3 seconds to change the selected set point or dead band value individually for each point.

When the display starts blinking, use the “UP” or “DOWN” arrow to select the desired value. Once the correct value is displayed, press the “ENT” button to accept and confirm the new value. The lower green digit display blinks 4 times rapidly and displays the new set point value.

7.2.1 pH Set Points

1. Press “AUTO” button to go to the beginning of the menu. The green indicator light should be on “LL”.
2. Press and hold the “MODE” button until the second display starts blinking.



3. Press the UP or DOWN arrow to adjust the Low Low alarm set point value, which is shown on the second display.



4. Press the “ENT” key to save the set point and the second display will blink rapidly to confirm.
5. Press the “MODE” button twice until the “L” indicator light lights up. Repeat steps 2 – 4 to change the Low, High, and HH set points.



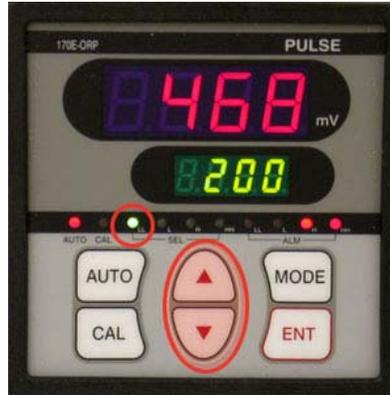
7.2.2 ORP Set Points

1. Press the “AUTO” button to go to the beginning of the menu. The green indicator light should be on “LL”.
2. Press and hold the “MODE” button until the second display starts blinking.



Second Display

3. Press the UP or DOWN arrow to adjust the Low Low alarm set point value, which is shown on the second display.



4. Press the "ENT" key to save the set point and the second display will blink rapidly to confirm.
5. Press the "MODE" button twice until the "L" indicator light lights up. Repeat steps 2 – 4 to change the Low, High, and HH set points.



7.3 Temperature (Optional)

	Factory Preset
Unit	F
High Setpoint	50
Low Setpoint	32
High Setpoint Hysteresis	1
Low Setpoint Hysteresis	1
Analog Output	4-20mA
Analog High	200
Analog Low	0
Thermocouple	J

7.3.1 Setup Temperature Unit

1. Press and hold the “E” and the “M” button for three seconds and the screen will display “cond”.
2. Press the “M” button until the display shows “Unit” and then “c” or “F”.
3. Press the “UP” button once to change to unit.
4. Press the “M” button to go the next parameter or press the “E” button to exit the setup.



7.3.2 Setup Temperature Sensor Type

1. Press and hold the “E” and “M” buttons for three seconds. The screen will display “cond”.
2. Press the “M” button until the display shows “rAnG” and then a sensor type.
3. Press the “UP” arrow to change to “J” if it is not showing “J”.
4. Press the “M” button to go the next parameter or press the “E” button to exit the setup.



7.3.3 Setup Analog Output Mode

1. Press and hold the “E” and “M” buttons for three seconds. The screen will display “cond”.
2. Press the “M” button until the display shows “A.OUT”.
3. Press the “UP” arrow to change the analog output mode: 0-1V, 0-10V, 1-5V, or 4-20mA.
4. Press the “M” button to go the next parameter or press the “E” button to exit the setup.



7.3.4 Setup Temperature Setpoints and Hysteresis

1. Press and hold the “E” and “M” buttons for three seconds. The screen will display “cond”.
2. Press the “RIGHT” arrow once. The display should show “con”.
3. Press the “M” button once and the display shows “S-Hi”. Then press the “M” button again to change the setpoint value.
3. Press the “UP” and “RIGHT” arrow to change the setpoint. The “RIGHT” arrow is to move between



digits and the “UP” arrow is to change the number.

4. Press the “M” button until the display shows “S-Lo” and then press the “M” button again to change the setpoint value.
5. Press the “UP” and “RIGHT” arrow to change the setpoint.



6. Press the “M” button until the display shows “H-Hi” and then press the “M” button again to change the hysteresis value.
7. Press the “UP” and “RIGHT” arrow to change the value.



8. Press the “M” button until the display shows “H-Hi” and then press the “M” button again to change the hysteresis value.
9. Press the “UP” and “RIGHT” arrow to change the value.
10. Press the “E” button to exit the setup.



7.3.5 Setup Analog High and Low Range

1. Press and hold the “E” and “M” buttons for three seconds. The screen will display “cond”.
2. Press the “RIGHT” arrow twice and the display should show “NEt”.
3. Press the “M” button until the display shows “AoHI”.
4. Press the “UP” and “RIGHT” arrow to change the analog high. The “RIGHT” arrow is to move between digits and the “UP” arrow is to change the number.
5. Press the “M” button to go the next parameter or press the “E” button to exit the setup.



6. Press and hold the “E” and “M” buttons for three seconds. The screen will display “cond”.
7. Press the “RIGHT” arrow once. The display should show “NEt”.
8. Press the “M” button until the display shows “AoLo”.
9. Press the “UP” and “RIGHT” arrow to change the analog low.
10. Press the “E” button to save the change.



7.3.6 Change Offset

1. Press and hold the “M” and “RIGHT” arrow buttons for three seconds. The screen will display “SHF”.
2. Press the “UP” and “RIGHT” arrow to change the offset. The “RIGHT” arrow is to move between digits and the “UP” arrow is to change the number.
3. Press the “M” button to save the value.
4. Press the “E” button to exit the menu.



7.4 Chemical Metering Pump Control



EZ Series



EW Series



EK Series



EH Series

7.4.1 Priming

With the pump turned on but not pumping, set stroke length at 100% and frequency to 360 strokes per minute (SPM). If the pump is equipped with an air vent valve, open the knob a half turn. Liquid should move up through the suction tubing and into the pump head. When the liquid starts running through the vent side tubing, close the air vent knob and continue with output adjustment (See pump manual for details).

If the pump has no air vent valve, disconnect the discharge tubing from the injection valve. When liquid enters the discharge tubing at the pump head, stop the pump. Then reconnect the discharge tubing to the injection valve.

If the pump does not self prime, remove the check valve housing on the discharge and suction sides to make sure the cartridges and gaskets are in correct positions (See pump manual for details).

7.4.2 Pump to Control Panel

Connect the acid and oxidation pumps' power cord to the corresponding drop cords located at the bottom of the control panel (see Fig. 7). This will allow the control panel to turn the pump on / off when needed.

If you do not want to use the provided drop cords see section 6.1.3 for terminal strip layout.

8. Maintenance

8.1 Electrode Cleaning

Remove the electrodes from the flow cell. Take a 1:100 diluted solution of acid to water in a cup, and place the electrode front tip in the solution for at least two inches deep, for a minimum of five to fifteen minutes. Rinse the tip and re-check the calibration.

8.2 Calibration

8.2.1 pH Calibration

1. Place the pH probe in buffer solution 7.00 and allow sufficient time for the electrode to reach the buffer solution value.
2. Press and hold the "CAL" button for three seconds to initialize the calibration process.



3. The "CAL" indicator light will turn on and the top display will start blinking. The second display will display "4-7" for a few seconds.



4. The controller will automatically calibrate to the buffer solution value (pH 7.00). The first and second display will stop blinking after the controller is calibrated to pH 7.00. The second display will show “- 7”.

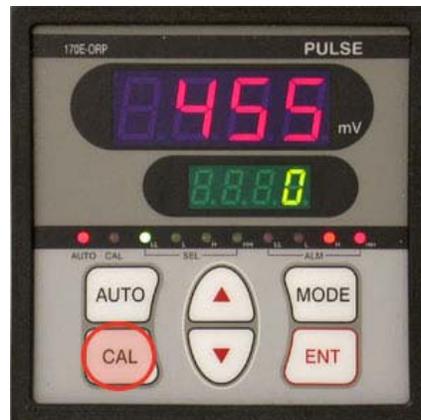


5. Rinse the electrode with water and place it in the pH 4.01 buffer solution and allow sufficient time for the electrode to reach the buffer solution value.
6. Press the “ENT” button.
7. The first display will start blinking and it will not stop blinking until the controller is calibrated to the buffer solution value (pH 4.01). The second display will show “4 - 7”.
8. Press the “ENT” button to save all calibration values. Follow the same steps if you are using pH 10.00 and pH 7.00 buffer solutions.

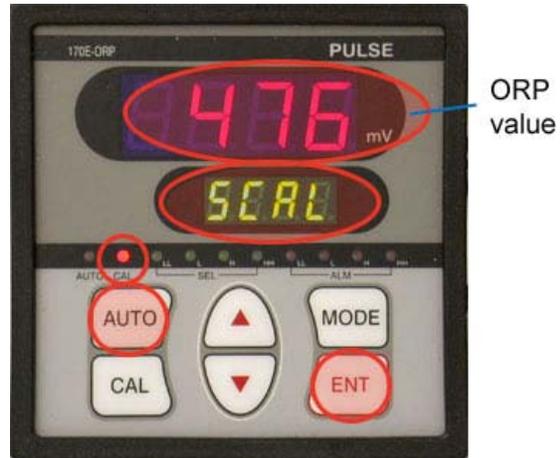


8.2.2 ORP Calibration

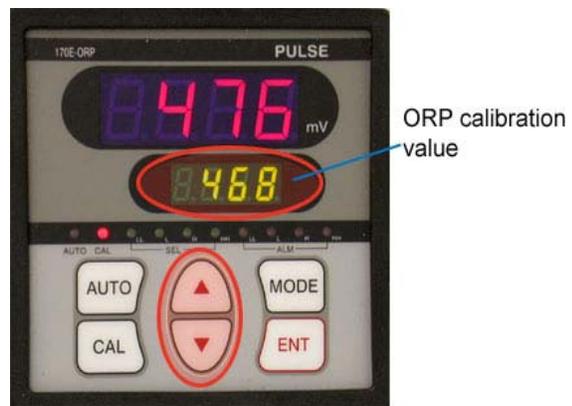
1. Place the ORP electrode into a known ORP standard solution (ORP-468). Press and hold the “CAL” button for three seconds.



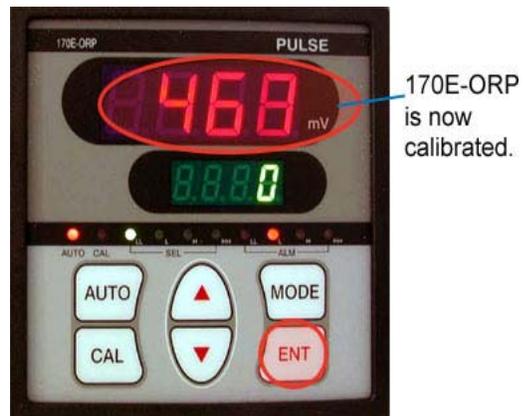
2. Press the "AUTO" button if the ORP value is already at the standard solution value (468). Press the "ENT" button to start the calibration if the ORP value is NOT the standard solution value. The "CAL" indicator light will turn on and the "SCAL" on the second display will start blinking.



3. Use the "UP" and "DOWN" arrow to adjust the ORP calibration value to match the known standard solution value (468).



4. Press the "ENT" button to save the calibration value.



8.3 Electrode Replacement

Models PI0020-pH and PI0020-ORP are both high chlorine tolerance electrodes. To replace the electrode, first disconnect the cable BNC connector by turning a half turn counterclockwise (see Fig. 6). DO NOT USE EXCESSIVE FORCE. Lift the BNC and disconnect it from the electrode.

The electrode will easily slip out of the Electrode Flow Cell. Place the electrode tip in a protective cap with some buffer solution or water.

Take the new electrode and remove the protective cap at the bottom of the electrode. Calibrate the electrode using appropriate calibration standards. Place the electrode in the Electrode Flow Cell and finger-tighten the compression nut. DO NOT USE EXCESSIVE FORCE.

8.4 Chemical Metering Pump

Periodically check the chemical tank level to avoid the pump from operating without liquid. Check the pump operating condition at least every 6 months: pump head position, screws, bolts, and seals. Check more frequently if using aggressive chemical. Also, clean the hydraulic parts, such as valves and filter, as often as needed (See pump manual for details).

8.5 Surge Suppressor



A surge suppressor is used to protect the control panel to prevent damage from loads voltage surges, spikes, and electrical line noise. The green LED on the surge suppressor indicates that the surge suppressor is working. If the green LED is off, this indicates that power is not being supplied to the surge suppressor. In addition, the LED will not illuminate if there has been a utility power failure or a short circuit.

Periodically check the surge suppressor to ensure reliable system performance.

9. Troubleshooting Guide

9.1 Control system failed

If the control system failed to work, such as pumps are not pumping when they are suppose to, you can reset the PLC to fix this problem. If by resetting the PLC does not fix the problem, please contact the factory.



To reset the PLC located on back plate inside of the control panel, toggle the switch to STOP (to the right), then to RUN (to the left without stopping in the middle). Finally, position the toggle switch to TERM (to the middle).

9.2 Electrode failed

Unscrew the electrode from the threaded holder and place in known calibration standards: pH in pH 7.00 and 4.00 solutions and ORP in 468 mV solution. The readings on the control panel should match or should be close. Follow calibration procedure. If the readings are too far off the standard readings, follow maintenance procedure as described in the section 9.4.

9.3 Electrode cable is damaged

Follow the electrode cable carefully along its length and check for any cuts, breaks, or tight kinks. If the cable is damaged, replace electrode.

9.4 Electrodes need maintenance

If other parameters seem normal but the readings seem abnormal in calibration standards, service the electrodes. Take a 1:100 diluted solution of acid to water in a cup and place the electrode front tip in the solution for at least 2 inches deep for a minimum of five to fifteen minutes. Rinse the tip and recheck calibration.

Calibration should be performed at least once per week for continuous measuring.

Place the pH electrode in a cup of pH 7.00 solution immersed minimum two inches. The pH controller should read 7.00 on the display. If not, follow the instructions in Section 8.2.1 to calibrate the controller.

ORP electrode normally does not drift out of calibration, however a checking solution at 468 mV is supplied to serve as a check. Please follow the instructions in Section 8.2.2 to calibrate the controller.

9.5 Controller failed

9.5.1 pH

In normal operation, when the display reading is above the set point value for acid control, the acid pump is turned on and when the reading reaches the set point it turns off the chemical pump. During the chemical adjustment period the Y0 light (see Section 2) on the PLC controller is on. This is an indication that the acid pump should be on. If Y0 is on and the pump is not operating, it may be that the relay contact in the controller has failed.

9.5.2 ORP

In normal operation, when the display reading is below the set point level for OXID control and the pH pump (Y0) is not on, the chlorine pump is turned on and when the reading reaches the set point it turns the chemical pump off. During the chemical adjustment period the Y1 light on the PLC controller is on. This is an indication that the oxidation pump should be activated. If the Y1 light (see Section 2) is on and the pump is not operating, it may be that the relay contact in the controller has failed.

Unplug the chemical pump and with a voltmeter check if 110VAC is being put out at the receptacle of the pump while the Y0 or Y1 light is on. If there is no power, the controller needs to be replaced. Contact the factory.

9.6 Controller Error Message

The controller's error messages are displayed on the second screen of the controller.

Error Code	Explanation	Solution
E-oF	<ul style="list-style-type: none"> pH / ORP value is over the high limit. pH value is higher than 15.0 pH. ORP value is higher than 1501 mV. 	<ul style="list-style-type: none"> Check electrode connection and cable. Check the solution.
E-uF	<ul style="list-style-type: none"> pH / ORP value is below the low limit. pH value is lower than -1.0 pH. ORP value is lower than -1501 mV. 	<ul style="list-style-type: none"> Check electrode connection and cable. Check the solution.
E-C1	<ul style="list-style-type: none"> Electrode needs cleaning. Old standard calibration solution. 	<ul style="list-style-type: none"> See Section 8.1 for electrode cleaning instructions. Change calibration solution. Change electrode.
E-C2	<ul style="list-style-type: none"> Big difference between the displayed value and the standard calibration solution value. 	<ul style="list-style-type: none"> See Section 8.1 for electrode cleaning instructions. Change calibration solution. Change electrode.
E-C3	<ul style="list-style-type: none"> Wrong standard calibration solution. 	<ul style="list-style-type: none"> Change calibration solution. Make sure the calibration solution is pH 4, 7, or 10.
E-t1	<ul style="list-style-type: none"> No temperature compensation. 	<ul style="list-style-type: none"> Temperature sensor or resistor is missing on controller terminal 11 and 12. Replace resistor or electrode.
E-t2	<ul style="list-style-type: none"> No temperature compensation. There is a short circuit. 	<ul style="list-style-type: none"> Temperature sensor or resistor is short circuit on controller terminal 11 and 12. Replace resistor or electrode.
E-t3	<ul style="list-style-type: none"> Temperature is over the high limit. Temperature is higher than 110°C. 	<ul style="list-style-type: none"> Temperature sensor or resistor connection on controller terminal 11 and 12. Do not use electrode over the temperature limit.
E-t4	<ul style="list-style-type: none"> Temperature is below the low limit. Temperature is lower than -10°C. 	<ul style="list-style-type: none"> Temperature sensor or resistor connection on controller terminal 11 and 12. Do not use electrode over the temperature limit.
E-S1	<ul style="list-style-type: none"> Controller system error. Loss of memory. 	<ul style="list-style-type: none"> Contact the factory.
E-S2	<ul style="list-style-type: none"> Controller system error. Defective A/D converter. 	<ul style="list-style-type: none"> Contact the factory.

9.7 Chemical Pump failed

If the pump receptacle has 110VAC output, but the pump is not turning on, check to make sure the pump is in the on position and at least 50% stroke and frequency. If the pump still does not turn on, it means the pump has failed and need service.

10 Contact

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